

CLAIMS

1. A control apparatus for a secondary battery (100) incorporated in a vehicle, comprising:

5 sensing means (110, 120, 130) for sensing a state quantity related to travel of said vehicle;

 predicting means (200) for predicting, ascribable to said state quantity, a degree of deterioration of said secondary battery (100) due to charging in regenerative braking of said vehicle; and

10 limiting means (200) for limiting, based on said predicted degree of deterioration, an amount of electric energy to be charged in said regenerative braking.

2. The control apparatus for a secondary battery (100) according to claim 1, wherein

15 said predicting means (200) includes means for predicting a degree of deterioration ascribable to an increase in temperature of said secondary battery (100).

3. The control apparatus for a secondary battery (100) according to claim 2, wherein

20 said predicting means (200) includes means for predicting said degree of deterioration to be higher as the increase in temperature of said secondary battery (200) is predicted to be higher.

4. The control apparatus for a secondary battery (100) according to claim 1, wherein

25 said sensing means (110, 120, 130) includes means for sensing a vehicle speed of said vehicle, and

 said predicting means (200) includes means for predicting said degree of

deterioration to be higher as said vehicle speed is higher.

5. The control apparatus for a secondary battery (100) according to claim 1,
wherein

5 said sensing means (110, 120, 130) includes means for sensing a vehicle speed of
said vehicle, and

 said predicting means (200) includes means for predicting said degree of
deterioration to be high when a period during which said vehicle speed is higher than a
predetermined speed lasts longer than a predetermined period.

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6. The control apparatus for a secondary battery (100) according to claim 1,
wherein

 said sensing means (110, 120, 130) includes means for sensing a vehicle speed of
said vehicle, and

15 said predicting means (200) includes means for predicting said degree of
deterioration to be high when a period during which said vehicle speed is higher than a
predetermined speed continuously lasts longer than a predetermined period.

7. The control apparatus for a secondary battery (100) according to claim 1,
wherein

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 said sensing means (110, 120, 130) includes means for sensing a vehicle speed of
said vehicle, and

 said predicting means (200) includes means for predicting said degree of
deterioration to be high when a frequency of said vehicle speed being higher than a
predetermined speed is higher than a predetermined frequency.

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8. The control apparatus for a secondary battery (100) according to claim 1,
wherein

said sensing means (110, 120, 130) includes means for sensing an amount of electric energy to be charged into said secondary battery (100), and

said predicting means (200) includes means for predicting said degree of deterioration to be high when a period during which said amount of electric energy to be charged is greater than a predetermined amount of electric energy lasts longer than a predetermined period.

9. The control apparatus for a secondary battery (100) according to claim 1, wherein

said sensing means (110, 120, 130) includes means for sensing an amount of electric energy to be charged into said secondary battery (100), and

said predicting means (200) includes means for predicting said degree of deterioration to be high when a period during which said amount of electric energy to be charged is greater than a predetermined amount of electric energy continuously lasts longer than a predetermined period.

10. The control apparatus for a secondary battery (100) according to claim 1, wherein

said sensing means (110, 120, 130) includes means for sensing an amount of electric energy to be charged into said secondary battery (100), and

said predicting means (200) includes means for predicting said degree of deterioration to be high when a frequency of said amount of electric energy to be charged being greater than a predetermined amount of electric energy is higher than a predetermined frequency.

11. The control apparatus for a secondary battery (100) according to claim 1, wherein

said predicting means (200) includes means for predicting a degree of

deterioration of said secondary battery (100) due to charging in regenerative braking of said vehicle, considering a state of said secondary battery (100).

12. The control apparatus for a secondary battery (100) according to claim 1,
5 wherein

cooling means for cooling said secondary battery (100) is incorporated in said vehicle, and

said control apparatus further comprises control means (200) for controlling cooling capacity of said cooling means based on said predicted degree of deterioration.

10 13. A control method for a secondary battery (100) incorporated in a vehicle, comprising the steps of:

sensing (S100, S110, S120) a state quantity related to travel of said vehicle;

15 predicting, ascribable to said state quantity, a degree of deterioration of said secondary battery (100) due to charging in regenerative braking of said vehicle; and

limiting (S150), based on said predicted degree of deterioration, an amount of electric energy to be charged in said regenerative braking.

20 14. The control method for a secondary battery (100) according to claim 13, wherein

said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting a degree of deterioration ascribable to an increase in temperature of said secondary battery (100).

25 15. The control method for a secondary battery (100) according to claim 14, wherein

said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting said degree of deterioration of said secondary battery (100)

to be higher as the increase in temperature of said secondary battery (200) is predicted to be higher.

16. The control method for a secondary battery (100) according to claim 13,
5 wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of sensing a vehicle speed of said vehicle, and

said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting said degree of deterioration to be higher as said vehicle
10 speed is higher.

17. The control method for a secondary battery (100) according to claim 13,
wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of
15 sensing a vehicle speed of said vehicle, and

said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting said degree of deterioration to be high when a period during which said vehicle speed is higher than a predetermined speed lasts longer than a predetermined period.

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18. The control method for a secondary battery (100) according to claim 13,
wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of sensing a vehicle speed of said vehicle, and

said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting said degree of deterioration to be high when a period during which said vehicle speed is higher than a predetermined speed continuously lasts longer than a predetermined period.

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19. The control method for a secondary battery (100) according to claim 13,
wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of
5 sensing a vehicle speed of said vehicle, and

said step of predicting a degree of deterioration of said secondary battery (100)
includes a step of predicting said degree of deterioration to be high when a frequency of
said vehicle speed being higher than a predetermined speed is higher than a
predetermined frequency.

20. The control method for a secondary battery (100) according to claim 13,
wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of
sensing an amount of electric energy to be charged into said secondary battery (100),
15 and

said step of predicting a degree of deterioration of said secondary battery (100)
includes a step of predicting said degree of deterioration to be high when a period
during which said amount of electric energy to be charged is greater than a
predetermined amount of electric energy lasts longer than a predetermined period.

21. The control method for a secondary battery (100) according to claim 13,
wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of
sensing an amount of electric energy to be charged into said secondary battery (100),
25 and

said step of predicting a degree of deterioration of said secondary battery (100)
includes a step of predicting said degree of deterioration to be high when a period
during which said amount of electric energy to be charged is greater than a

predetermined amount of electric energy continuously lasts longer than a predetermined period.

22. The control method for a secondary battery (100) according to claim 13,
5 wherein

said step of sensing a state quantity (S100, S110, S120) includes a step of sensing an amount of electric energy to be charged into said secondary battery (100), and

10 said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting said degree of deterioration to be high when a frequency of said amount of electric energy to be charged being greater than a predetermined amount of electric energy is higher than a predetermined frequency.

23. The control method for a secondary battery (100) according to claim 13,
15 wherein

said step of predicting a degree of deterioration of said secondary battery (100) includes a step of predicting a degree of deterioration of said secondary battery (100) due to charging in regenerative braking of said vehicle, considering a state of said secondary battery (100).

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24. The control method for a secondary battery (100) according to claim 13, wherein

a secondary battery (100) cooling apparatus for cooling said secondary battery (100) is incorporated in said vehicle, and

25 said control method further comprises a step of controlling cooling capacity of said secondary battery (100) cooling apparatus based on said predicted degree of deterioration.

25. A control apparatus for a secondary battery (100) incorporated in a vehicle, comprising:

a sensor (110, 120, 130) sensing a state quantity related to travel of said vehicle;
and

5 an electronic control unit (200) predicting, ascribable to said state quantity, a degree of deterioration of said secondary battery (100) due to charging in regenerative braking of said vehicle, and limiting, based on said predicted degree of deterioration, an amount of electric energy to be charged in said regenerative braking.

10 26. The control apparatus for a secondary battery (100) according to claim 25, wherein

said electronic control unit (200) predicts a degree of deterioration ascribable to an increase in temperature of said secondary battery (100).

15 27. The control apparatus for a secondary battery (100) according to claim 26, wherein

said electronic control unit (200) predicts said degree of deterioration to be higher as the increase in temperature of said secondary battery (200) is predicted to be higher.

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28. The control apparatus for a secondary battery (100) according to claim 25, wherein

said sensor (110, 120, 130) includes a sensor sensing a vehicle speed of said vehicle, and

25 said electronic control unit (200) predicts said degree of deterioration to be higher as said vehicle speed is higher.

29. The control apparatus for a secondary battery (100) according to claim 25,

wherein

said sensor (110, 120, 130) includes a sensor sensing a vehicle speed of said vehicle, and

5 said electronic control unit (200) predicts said degree of deterioration to be high when a period during which said vehicle speed is higher than a predetermined speed lasts longer than a predetermined period.

30. The control apparatus for a secondary battery (100) according to claim 25, wherein

10 said sensor (110, 120, 130) includes a sensor sensing a vehicle speed of said vehicle, and

 said electronic control unit (200) predicts said degree of deterioration to be high when a period during which said vehicle speed is higher than a predetermined speed continuously lasts longer than a predetermined period.

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31. The control apparatus for a secondary battery (100) according to claim 25, wherein

 said sensor (110, 120, 130) includes a sensor sensing a vehicle speed of said vehicle, and

20 said electronic control unit (200) predicts said degree of deterioration to be high when a frequency of said vehicle speed being higher than a predetermined speed is higher than a predetermined frequency.

25 32. The control apparatus for a secondary battery (100) according to claim 25, wherein

 said sensor (110, 120, 130) includes a sensor sensing an amount of electric energy to be charged into said secondary battery (100), and

 said electronic control unit (200) includes means for predicting said degree of

deterioration to be high when a period during which said amount of electric energy to be charged is greater than a predetermined amount of electric energy lasts longer than a predetermined period.

5 33. The control apparatus for a secondary battery (100) according to claim 25, wherein

 said sensor (110, 120, 130) includes a sensor sensing an amount of electric energy to be charged into said secondary battery (100), and

 said electronic control unit (200) predicts said degree of deterioration to be high
10 when a period during which said amount of electric energy to be charged is greater than a predetermined amount of electric energy continuously lasts longer than a predetermined period.

15 34. The control apparatus for a secondary battery (100) according to claim 25, wherein

 said sensor (110, 120, 130) includes a sensor sensing an amount of electric energy to be charged into said secondary battery (100), and

 said electronic control unit (200) predicts said degree of deterioration to be high
20 when a frequency of said amount of electric energy to be charged being greater than a predetermined amount of electric energy is higher than a predetermined frequency.

 35. The control apparatus for a secondary battery (100) according to claim 25, wherein

 said electronic control unit (200) predicts a degree of deterioration of said
25 secondary battery (100) due to charging in regenerative braking of said vehicle, considering a state of said secondary battery (100).

 36. The control apparatus for a secondary battery (100) according to claim 25,

wherein

a cooling fan for cooling said secondary battery (100) is incorporated in said vehicle, and

5 said electronic control unit (200) controls cooling capacity of said cooling fan
based on said predicted degree of deterioration.